**Collaborators :** None

**Sources** : Lecture Notes; <https://en.wikipedia.org/wiki/Quantum_Zeno_effect>

**Q3**  **Quantum Anti-Zeno Effect**

Assume you have a single qubit that you know is in the state You wish to change its state to You have the ability to build any measurement device, and use it as many times as you want. How can you almost surely get the qbit’s state changed to ?

Remark: More specifically, given , build a quantum circuit that outputs a qbit with probability at least . You are not allowed to apply gates (or rotations) to your qubit.

**Ans:** To change the state of a single qubit from  with a probability of at least , without using quantum gates, you can employ a probabilistic measurement strategy. Here's a step-by-step approach:

**Strategy for Changing Qubit State**

1. **Measurement Setup**: Design 2 measurement devices that measures the qubit in the {  basis ; and  and  basis respectively.
2. **Initial Measurement**: Measure the qubit in the  basis and then in  and   basis:
   * Whatever the result is whether initially, do nothing and then measure the intermediate output in  and  basis.
   * The input  has equal chance of outputting and in the first measurement. Be it or , the next measurement in  and  basis also has equal chance of outputting  and  .
   * So, the

1. **Repeat Measurements**: Repeat the measurement process after getting . Each time you get a result of , you have a chance that the qubit is in state  after the next measurement.
2. **Stopping Criterion**: Continue this process until we are confident that the probability of the qubit being in state  is at least .

After repeating this measurement for sufficiently large number of times, we can almost be sure to get as output.